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AN INDEX OF SOCIAL CONDITIONS IN THE COUNTY BOROUGHES IN 1931.

1. The object of this note is to suggest a method of constructing an index of the relative incidence of adverse social conditions in the County Boroughs of England and Wales. By social conditions we mean the environment of life in the Boroughs in so far as it is affected by quantitatively measurable economic factors,¹ in particular by poverty and bad housing conditions. We exclude the effects of factors such as climate and the specifically biological effects of certain types of employment, and attempt to form an index of the relative incidence of the joint effects of poverty and poor housing conditions in the Boroughs.

2. We may illustrate this object by considering some recent attempts to estimate the effect of 'non-medical' factors on mortality and morbidity rates. Examples of such work are McKinley (1929), R. G. (1934), Mitra (1937), Hart and Wright (1939), Wright and Wright (1942) and Woolf and Waterhouse (1945). In general, these writers have used the classical technique of partial correlation and multiple regression to measure the net influence of selected non-medical factors, including in particular poverty and bad housing, on certain mortality rates. For such measurement to be possible it is necessary to show first that there exist suitable indices of the incidence of the factors whose influence it is sought to estimate, and secondly that these indices are not highly multicollinear. If the second condition is not fulfilled, the values of the partial regression coefficients obtained will depend very much on somewhat arbitrary decisions as to the direction in which errors are to be assumed minimised. In Frisch's terms, the bunch-maps representing the regression coefficients of any pair of variables will be exploded by the introduction of any third variable. What we propose to do here is to show that while there do exist a number of indices of poverty in the County Boroughs, these indices are in fact so highly correlated with each other that they cannot be used simultaneously in multiple regression equations to establish the independent influence of each on the 'dependent' variable, but that the very fact of their being inter-correlated makes it possible to construct an index of 'General Social Conditions' analogous to the widely used indices of 'Business Activity'. We propose to do this by means of a form of Factor Analysis similar to that used by Rhodes (1937) in constructing an Index of Business Activity.

¹ Throughout this note the spelling of this overworked word with an initial capital is intended to indicate its use in the technical sense of Factor Analysis.

3. Consideration of the works quoted above shows that all the writers have used similar sets of 'explanatory' variables. These variables consist of (a) indices of income; (b) indices of the extent of overcrowding; (c) indices intended to measure other factors, such as climate and the employment of women in factories. (a) There being no direct information as to income per head in the County Boroughs, recourse has been had to indirect indices. The Local Unemployment Index, the proportion of the population falling in Classes IV and V of the Registrar-General's Occupational Classification in each C.B., and the Percentage of the population in receipt of Poor Relief have all been used as indirect measurements of the extent of poverty in the County Boroughs. It is not possible to estimate the accuracy of these indices, as far as the country as a whole is concerned. In the case of the Metropolitan Boroughs, however, some check is available in the information given in the New Survey of London Life and Labour for 1929-30. Wright and Wright (1942) showed that there is a high correlation ($r=0.876$) between the proportion of the population of each Metropolitan Borough falling into Classes IV and V of the R.G.'s occupational classification in 1931 and the percentage of the population living below the New Survey poverty line in 1929-30. On the other hand, the correlation of the 'Social Class Index' and the average income less rent of the inhabitants of the Metropolitan Boroughs was only -0.591 , suggesting that the Social Class Index was more reliable as an index of the extent of poverty in the areas than as one of the relative prosperity of the areas compared with each other. No similar comparison is possible in the case of the County Boroughs. The inter-correlations of the various estimates of the extent of poverty will be discussed later. The number of such indirect indices of poverty can be greatly increased. Certain Local Government finance statistics can be used, as well as estimates of the number of domestic servants per 100 of the population (Mitra 1937) but the precise significance of these indices is not always clear.

(b) The extent of overcrowding in the County Boroughs is indicated both in the Housing Tables of the 1931 Census, and in the Report of the Overcrowding Survey 1935-6. It is necessary merely to select some standard of 'overcrowding' from those available in the Census tables. Most writers have used the percentage of the population living at a density of more than two per room. There is a high correlation between this figure and that given in the 1935-6 Report, although the standard of overcrowding there adopted was entirely different and the Report relates only to the working-class population of the towns concerned (For 81 County Boroughs¹ $r=0.951$). As estimates of the relative extent of overcrowding in the County Boroughs during the thirties, therefore, the two indices are approximately equivalent.

(c) Certain writers, notably Woolf and Waterhouse (1945) and Mitra (1937) have used indices of essentially different factors. Following the R.G. (1934), Woolf and Waterhouse included the Latitude of the County Boroughs

¹ All C.B.'s except Bootle and West Ham, excluded because of the absence of a Local Unemployment Index for these areas.

as an explanatory variable in their work on the inter-local variation of the Infant Mortality Rate, together with the percentage of female inhabitants of the towns aged 14 or over engaged in factory trades. Mitra in investigating the influence of social conditions on the fertility rate in London Boroughs in 1931 included in his explanatory variables certain representative death rates. It is clear that all the additional indices are intended to measure the influence of specific factors other than the social conditions measured by the poverty indices and the housing index. The R.G. (1934), Woolf and Waterhouse and the Department of Health for Scotland (1943) intend the latitude factor to measure the probable relative exposure of the inhabitants of the County Boroughs to climatic conditions likely to be injurious to health. As all four would probably agree, it is almost certainly a very poor index for this purpose, because none of the apparently relevant factors (temperature, rainfall, mean daily hours of sunshine) appears to vary systematically with latitude as far as the County Boroughs are concerned. In the same way, the percentage of women employed in factory trades is apparently intended to be a measure not of social conditions as defined above, but of a logically (not not necessarily statistically) independent factor, as it would be unless the factory employment of women were highly correlated with the incidence of poverty. Woolf and Waterhouse found correlations of -0.0986 , -0.0217 and $+0.0768$ between this index and their indices of Unemployment, Overcrowding and the percentage in Occupational Classes IV and V respectively. Thus the percentage of women employed in factory occupations does not appear to be an index of poverty in the sense that the unemployment percentage, for instance, is. The correlation found between the women's employment index and the 'dependent' variable must, therefore, measure something other than the effect of a 'social factor' as here defined.¹ The same is probably true of the mortality rates introduced as explanatory variables into Mitra's study of the fertility rate.

4. If it is accepted that the Local Unemployment Index and the percentage of the population in Classes IV and V of the R. G.'s occupational classification, together with the Poor Relief rate per cent of the population and certain Local Government Finance statistics provide useful indices of the relative extent of poverty in the County Boroughs, while the number of persons per cent of the total population living at a density of more than two per room provides a good index of the extent of bad housing conditions, it remains to be shown how far it is permissible to use these indices simultaneously in multiple regression equations in which each regression coefficient shall be a good estimate of the net influence of each of the factors ostensibly measured by the indices. This involves an investigation of the values of the coefficients obtained by assuming errors minimised in the direction of each of the variables in turn (Frisch (1934)) and this may be done by means of bunch-map analysis. In general, consideration of the matrices of zero-order correlation coefficients reported by the writers cited leads us to the view that

¹ Possibly the specifically biological effect of the employment of women in industry.

both the correlations between the several poverty indices and that between these indices and the housing index are so high that it is impossible to distinguish their net influences by means of multiple regression analysis. We have not space to deal with this problem at length, but the validity of our conclusion will be supported by reference to the symmetrical correlation matrix in Table I which is taken from Woolf and Waterhouse (1945) and to that in Table III obtained by us from other data, if it is remembered that the regression coefficients (normalised) obtained from three zero-order correlation coefficients between three variables will be subject to great instability under changes in the minimization direction if one of them, r_{23} say, is near to the maximum value consistent with the observed values of the other two.¹

TABLE I.

Zero-order correlation coefficients between explanatory variables (Woolf and Waterhouse). (Identifying: 1, Housing density; 2, Unemployment percentage (av. of 12 months ended Dec. 31st; * 3, Social Class Index; 4, Percentage of women over 14 in factory occupations; 5, Latitude in degrees North of 53°30').

	1	2	3	4	5
1	1.0000	0.6378	0.6870	-0.0217	0.5288
2	...	1.0000	0.5353	-0.0986	0.4767
3	...	...	1.0000	0.0768	0.5007
4	...	...	...	1.0000	0.2867
5	...	...	...	...	1.0000

*Mean of 1931-1938 inclusive.

The nature of the correlation matrix in Table I supports the general impression that in the five indices used by Woolf and Waterhouse we have measures not of *five* distinguishable Factors but of *less* than five. It seems reasonable to suppose (a) that the two poverty indices (2 and 3) are measures of a common influence, and (b) that in addition poverty, as measured by these indices, is associated with bad housing conditions so closely that we are justified in thinking in terms of a General Social Factor measurable about equally well by either index. On the other hand, the small correlation between variable 4 and the others suggest that it measures a strictly (statistically) distinguishable Factor. It appears too that Latitude is only of interest in the context of these socio-medical investigations because of its correlation (*de facto*) with the Social Indices. That this is a reasonable interpretation is shown by the results of an analysis of the correlation matrix given in Table I on the lines suggested by Hotelling. This enables us to detect the existence of certain 'Principal Components' and the loading of each in each of the

¹ It might be thought that the problem of the multicollinearity of the 'explanatory' variables could be overcome by increasing the number of towns on which the estimates of the correlation between e.g. the Infant Mortality Rate and the Unemployment and Overcrowding indices are based. Investigation of these correlations in the case of 247 urban areas with populations of over 20,000 in 1931, however, shows that this is not so. Writing 1 for the I.M.R. in 1931, 2 for the Unemployment index, and 3 for the Overcrowding index, the three correlation coefficients were found to be, for the natural data, as follows: $r_{12}=0.593$; $r_{13}=0.547$; $r_{23}=0.430$. In selected sub-groups in which r_{23} approaches zero, the relative size of r_{123} and $r_{1,23}$ depends on the range of variables 2 and 3 in the sub-group considered.

indices used in the investigation. We identify the first Principal Component with the General Social Factor and expect to find this heavily and fairly equally loaded in each of variables 1, 2, 3, and probably 5. There will be another Principal Component which is more heavily loaded in variable 4, which we regard as reflecting some Factor other than adverse social conditions (*i.e.* perhaps the specific biological effect of factory employment of women). Table II gives the results of a partial Hotelling analysis of the correlations in Table I.

TABLE II.

First Two Principal Components and factor loadings of variables used by Woolf and Waterhouse.

Variable	Principal Component	
	I	II
1	0.875	-0.083
2	0.800	-0.210
3	0.836	+0.066
4	0.109	+0.985
5	0.762	-0.259
Sum of Squares	2.698	1.093
% of total Sum of Squares (5)	54	22

It will be seen that the first two Principal Components together account for about three quarters of the whole variance of the matrix of correlations among the variables used by Woolf and Waterhouse to explain the variance of the infant mortality rates. Of the two, the first Principal Component is more than twice as important as the second, and its loadings in the four variables 1, 2, 3, and 5 are of the same order and much larger than the loading in variable 4 (the female factory employment index). The second Principal Component is much more heavily loaded in variable 4 than in any of the others, and is negatively loaded in 1, 2 and 5. We take these results to show that the five indices used by Woolf and Waterhouse represent measurements of *two* essentially independent Factors, one a General Social Factor and the other perhaps a specifically biological one.

5. If this conclusion is valid, it follows that it will not be possible to use the several indices of relative poverty and bad housing simultaneously in investigations of this general type. There are, therefore, two possibilities. Either the inter-correlation of the poverty indices and the housing index can be recognized and used in the sense that one of these will be selected and used *not* as an index of unemployment *as such*, nor even as an index of poverty as such, but as an index of the incidence of generally adverse social conditions, which means using the index partly as an index of bad housing conditions and partly as an index of the extent of employment in low-paid occupations as well. Or, alternatively, we can use our estimates of the inter-correlation of the poverty and housing indices to construct an index of General Social Conditions based on selected primary indices weighted in proportion to their loading with the General Social Factor. This is in effect what Rhodes (1937) proposed in the case of his Index of Business Activity, and it is the alternative we propose to adopt here.

6. It is first necessary to select the primary indices. There is no obvious limit to the number available, and only experience and knowledge of the precise significance of each can determine the selection. The Local Unemployment Index, the Social Class Index, the Poor Relief percentage and the Housing Index are obvious choices. In addition we have included an index of the rate income of the County Boroughs as a further index of local poverty.

The unemployment Rate used is the average of the Local Unemployment Rate over the 18 months ended December 1931. This form of the index was used mainly because it had already been computed for another purpose and was, therefore, readily available. The Social Class Index is the percentage of the population included in Classes IV and V of the R.G.'s classification. The Poor Relief index is the number of persons per 10,000 of the population in receipt of domiciliary poor relief at January 31st, 1931. It would probably have been more satisfactory to use the mean of the four quarterly figures for the year, but this was not practicable at the time and our object is primarily to illustrate the method. The Housing Index is the percentage of the population in private families living at a density of more than two per room at the time of the 1931 Census. The index of rate income of the County Boroughs is the reciprocal of the proceeds per head of a rate of one penny in each pound of rateable value in the year ended March 31st, 1932. The advantages of the proceeds of a penny rate as an index of the wealth of local authorities, as well as its shortcomings for this purpose, have been discussed by Hicks and Hicks (1943). We have used its reciprocal in order to avoid negative correlation coefficients. The calculations were carried out in terms of the logarithms of all the variables except the reciprocal of the penny rate per head, because the logs of the Unemployment Index, the Poor Relief percentage, the Social Class Index and the Housing Index showed more symmetrical distributions than the natural data. The reciprocal of the proceeds per head of a penny rate is however fairly symmetrically distributed. The zero-order correlation coefficients are shown in Table III.

Some of these correlation coefficients are rather smaller than the coefficients obtained for the natural data by other writers, but the fact that our estimates are based on the logs of the primary series whose distribution is

TABLE III.

*Correlation Coefficients between primary indices of Social Conditions in 81 County Boroughs 1931.**

(Identifying: 1, Log mean Unemployment percentage 18 months ended Dec. 1931; 2, Log percentage living at more than two per room; 3, Log percentage in Classes IV and V (R.G.); 4, Reciprocal of product per head of penny rate; 5, Log number per 10,000 in receipt of domiciliary Poor Relief Dec. 31st, 1931).

	1	2	3	4	5
1	1.0000	0.3857	0.2919	0.4012	0.2809
2		1.0000	0.6677	0.5572	0.2915
3			1.0000	0.6581	0.3332
4				1.0000	0.3024
5					1.0000

*All C.B.'s except Bootle and West Ham (see p. 366).

more symmetrical than that of the natural data increases the reliability of our estimates. All the correlation coefficients in Table III are greater than the value for r with 80 D.F. and $P=0.01$, namely 0.283, except r_{15} which is greater than the value of r at $P=0.05$ (*i.e.* 0.217). The rather high correlations between the rate income index, 4, and the other indices suggest that for this year at any rate the proceeds of a penny rate per head may have been a better index of local wealth than Hicks and Hicks supposed.

6. We proceed to find the loadings of the five primary series with the First Principal Component of the correlation matrix. The First Principal Component will be identified with the General Social Factor, and the loadings represent the correlations between it and the normalized primary series. The loadings are shown in Table IV.

TABLE IV.
Loadings of First Principal Component in the five primary series.

Series	Loading
1	0.6067
2	0.8202
3	0.8407
4	0.8234
5	0.5448
Sum of Squares	2.7226
% Total Sum of Squares	54

The General Social Factor appears to be more highly correlated with the housing (2), 'social class' (3), and 'rate income' (4) indices than with either the unemployment (1) or the poor relief (5) indices. The first three would appear to be about equally useful as measurements of the strength of the General Social Factor in the C.B.'s. We have retained the unemployment and poor relief indices in the construction of our General index because some measure of the extent of unemployment seems essential in any attempt to measure the incidence of adverse social conditions. The low weights of these two indices may appear surprising and certainly have an effect on the value of the Final Index, G , in some towns (notably Cardiff and Swansea). The next step in the construction of the index is to apply the loadings of Table IV to the deviations of the respective primary indices from their means, measured in terms of their own standard deviations, and to sum the products.⁵ The results (G') are shown in Table V. In order to eliminate negative signs, the index G' was adjusted by transferring the origin to zero at the value (-8.32) which would have been observed if the lowest observed values of all five primary series had occurred *simultaneously* in one town. The resulting positive values were then expressed as percentages of their own mean. The results are our Final Index of General Social Conditions, G , shown in Table VI.

If ⁵ *i.e.* $g_1, g_2 \dots g_5$ represent the respective loadings of the five primary series with the General Factor, $x_1, x_2 \dots x_5$ the deviations of the primary series from their means and $\sigma_1, \sigma_2 \dots \sigma_5$ their respective standard deviations:

$$G' = g_1 \frac{x_1}{\sigma_1} + g_2 \frac{x_2}{\sigma_2} + \dots + g_5 \frac{x_5}{\sigma_5}$$

TABLE V.

Index of Social Conditions in 81 County Boroughs, G'.
(Sum of weighted normalised deviations from means of primary series).

C.B.	G'	C.B.	G'
Barnsley	+3.96	Manchester	-0.46
Barrow-in-Furness	+1.01	Middlesbrough	+3.99
Bath	-4.76	Newcastle-on-Tyne	+1.86
Birkenhead	+1.76	Northampton	-3.38
Birmingham	-0.86	Norwich	-0.97
Blackburn	-1.49	Nottingham	-0.47
Blackpool	-4.29	Oldham	+0.91
Bolton	+0.57	Oxford	-5.48
Bournemouth	-7.40	Plymouth	-0.95
Bradford	+0.18	Portsmouth	-1.86
Brighton	-3.62	Preston	+1.19
Bristol	-0.92	Reading	-2.91
Burnley	-0.20	Rochdale	+0.46
Burton-on-Trent	-0.23	Rotherham	+2.59
Bury	-0.79	St. Helens	+4.38
Canterbury	-3.02	Salford	+2.10
Carlisle	-0.03	Sheffield	+1.92
Chester	-0.52	Smethwick	+0.09
Coventry	-1.38	Southampton	-1.74
Croydon	-2.55	Southend	-5.72
Darlington	+0.11	Southport	-7.37
Derby	+0.61	South Shields	+4.53
Dewsbury	+1.54	Stockport	-0.22
Doncaster	-1.92	Stoke-on-Trent	+2.17
Dudley	+2.67	Sunderland	+3.26
Eastbourne	-2.94	Tynemouth	+3.21
East Ham	-0.82	Wakefield	+0.90
Exeter	-0.01	Wallasey	-2.89
Gateshead	+4.51	Walsall	+2.38
Gloucester	-1.39	Warrington	+2.51
Great Yarmouth	-0.54	West Bromwich	+2.76
Grimsby	+1.37	West Hartlepool	+4.06
Halifax	+0.32	Wigan	+3.24
Hastings	-3.94	Wolverhampton	+0.20
Huddersfield	-0.49	Worcester	-1.17
Ipswich	-2.02	York	+0.17
Kingston-on-Hull	+2.46	Cardiff	-0.14
Leeds	-0.01	Merthyr Tydfil	+5.12
Leicester	-3.08	Newport (Mon.)	+0.72
Lincoln	+0.48	Swansea	+1.68
Liverpool	+1.86		

7. Space permits only a few general observations on the results, the validity of which can only be tested by comparison with other data, quantitative and qualitative. In general, there are few obviously astonishing values of G. One would have expected higher values in the case of Cardiff, Newport and Swansea and in the Lancashire boroughs, while the values for Eastbourne and Hastings are higher than might be expected. Certainly, our Index does not appear to be and could not be expected to be a very accurate index of relative income per head. The incidence of unemployment, which may be regarded as an index of poverty, is relatively lightly weighted in the Final Index, and it may not be, in fact, a particularly sensitive index of poverty, partly because the Local Unemployment Index takes no account of part-time working and various forms of disguised unemployment. The Poor Relief Rate is weakened as an index of the extent of poverty because it is

TABLE VI.

*Index of Social Conditions in County Boroughs in 1931.**Final Index G.*

(Mean of G' (adjusted to base -8.32)=100).

Barnsley	148.8	Manchester	95.1
Barrow-in-Furness	113.0	Middlesbrough	149.2
Bath	43.1	Newcastle-on-Tyne	123.3
Birkenhead	122.1	Northampton	59.8
Birmingham	90.4	Norwich	89.1
Blackburn	82.7	Nottingham	95.1
Blackpool	48.8	Oldham	111.7
Bolton	107.7	Oxford	34.4
Bournemouth	11.1	Plymouth	89.2
Bradford	102.9	Portsmouth	78.3
Brighton	56.9	Preston	115.2
Bristol	89.6	Reading	65.5
Burnley	98.3	Rochdale	106.4
Burton-on-Trent	97.9	Rotherham	132.2
Bury	91.3	St. Helens	153.9
Canterbury	64.2	Salford	126.2
Carlisle	100.4	Sheffield	124.1
Chester	94.4	Smethwick	101.8
Coventry	84.1	Southampton	79.7
Croydon	69.8	Southend	31.5
Darlington	102.2	Southport	11.4
Derby	108.2	South Shields	155.6
Dewsbury	119.5	Stockport	98.1
Doncaster	77.5	Stoke-on-Trent	127.1
Dudley	133.1	Sunderland	140.3
Eastbourne	65.2	Tynemouth	139.6
East Ham	90.9	Wakefield	111.7
Exeter	100.7	Wallasey	65.8
Gateshead	155.5	Walsall	129.5
Gloucester	83.9	Warrington	131.2
Great Yarmouth	94.2	West Bromwich	134.2
Grimsby	117.4	West Hartlepool	149.9
Halifax	104.7	Wigan	140.0
Hastings	53.0	Wolverhampton	103.2
Huddersfield	94.8	Worcester	86.6
Ipswich	76.3	York	102.8
Kingston-on-Hull	130.5	Cardiff	99.1
Leeds	100.6	Merthyr Tydfil	162.7
Leicester	63.5	Newport (Mon.)	109.5
Lincoln	106.5	Swansea	121.1
Liverpool	123.3		

partly an index of the ability of the authorities to give domiciliary relief and of their willingness to do so. Our index is based heavily on the Occupational structure of the Borough populations in 1931, on the extent of overcrowding and on the rate income per head. It is not clear how far the occupational classification can be regarded as a sensitive index of poverty, particularly as it does not take account of unemployment nor of possible divergences in depression of actual and nominal occupations (the drift into lower-paid occupations of those still regarding themselves as belonging to more highly-skilled trades). The housing index is apparently a moderately good index of what it purports to measure, though the true social significance of a given rate of overcrowding probably varied from town to town according to local variations in the typical age, size and structure of houses. The rate-income index is subject to errors as an index of local wealth as a result of variations

in the basis of valuation. The relatively low weight given to unemployment and poor relief and the peculiarities of the valuation for rating may explain the obvious anomalies in the values of G which we have mentioned.

The Index could probably be improved by experimental inclusion of other primary series. The essential point is that this approach to the problem avoids the danger of obtaining spuriously accurate estimations of the net influence on other social phenomena of what are not statistically distinguishable Factors.

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RATIONING AND NUTRITION

INEXPENSIVE FAMILY DIETS IN NOVEMBER, 1946

I. *Introductory.*

Since our last inquiry into the cost of a 'human needs' diet in Oxford, in April, 1946,¹ there has occurred in the system of food rationing an extension of fundamental importance. Up to the summer of 1946, the staple calorific foods—bread, flour, and other main wheat products—had remained unrationed, and however inadequate in various respects an individual might have found his diet, no one could complain that he ever had to go hungry. A pound of bread could be purchased for 2½d, and it would provide him with 37 per cent of the daily calorific requirements of an average male adult, with nearly 55 per cent of the corresponding requirement of protein, and, in addition, with fair amounts of calcium, iron, and vitamin B₁. Rationing of all the main grain products was considered necessary in order to curtail the total consumption of grain by eliminating waste. Yet it is undeniable that there are inherent dangers in a system of rationing of these basic foods, since it has to fall back on loose estimates of average requirements and thus takes small account of the wide variations in the actual needs of individuals. In fact it appears that under the existing system of bread rationing, some people are going short while others are allowed too much. This is a point which emerges from the present survey, although we, too, are only considering standard types and their food requirements and not exceptions. Since, however, our survey is limited to the question of the nutrition of a family with young children as a unit, it is possible to evolve a diet schedule that obviates certain defects in the system of fixed individual rations by treating them as a family pool, which permits a distribution more in keeping with individual needs.

This aspect of the rationing problem is only an incidental outcome of our inquiry, which is primarily concerned with ascertaining the minimum outlay at which, during a given period, it would be possible to purchase a reasonably satisfactory diet for a family consisting of husband, wife, and three children of school age. The structure of the family and, indeed, the whole inquiry suggested themselves to us by Mr. S. Rowntree's pre-war inquiry into what he termed 'the human needs of labour'. The diet schedule which we present each year for April and November is not, therefore, intended to show a diet that, from the nutritionist's viewpoint, is perfect. Our aim is rather to convey an idea of how, in practice, an intelligent and adaptable housewife with very limited means might solve the problem of feeding her family moderately well, and at what cost. An important corollary to this is that as far as individual nutrition within the family is concerned, it must be derived from meals which, as a rule, are taken in common. It would impose an impossible task upon the housewife were she to prepare special diets for the several members of her family in order to ensure for each individual the optimum intake of nutrients, and there can be little doubt that such a procedure, were

¹ The eleventh in this series. BULLETIN, Vol. 8, No. 6.

it feasible, would be bad for family morale. Certain judicious adjustments are, of course, necessary, and are habitually being made, in the allotment of the individual shares of the family meals, although not always for nutritional reasons.

2. *Constituents of a 'Human Needs' Diet and its Cost.*

A 'human needs' diet that could be bought in Oxford in November 1946, by a family of 5 persons, is set out in Table I; or, to be precise, it seemed that this diet was available in most districts of the town. It is impossible to generalize any further; for perhaps never before has shopping for a family been more difficult in Oxford than it was during that period. This was probably partly due to the large influx of students, which was not sufficiently provided for by the quantities of foods that reached the shops. Certain shops offered certain desirable foods, but anything that was scarce was frequently reserved only for registered customers, or, if that was not the case, for the person who had time and strength for standing in queues, and, in general, housewives found it hard to spend their 'points' economically.

Some could obtain no oatmeal at all; rolled oats had vanished. A few complained that their grocer had no dried eggs. The only dried fruit on the market was prunes. Semolina, which in April sold in the less expensive shops at 4d. a lb, was priced everywhere at 7d., and macaroni cost 9d. instead of 7d. These two foods were unrationed in April, but on 'points' in November. Everyday shopping tended to be a lengthy and disappointing business, and it made housewives reluctant to walk to more distant shops for the sake of small bargains. Altogether, the diet shown in Table I cannot claim the same all-round validity as those given in previous articles, but it is the most general aspect of a wholesome and inexpensive diet that we can present, and modifications of it, some of which allow for the replacement of dried eggs and/or oatmeal by other foods, will be found in Table II.

The number of changes that had to be introduced into the diet schedule for April is substantial. On account of the shortage of oatmeal only one pound was included for November instead of 2½ lbs. Oatmeal is essentially a breakfast food, and it must be replaced by foods that are dietetically acceptable in its place; for, as regards food, human taste is decidedly conservative. With respect to its calorific value bread is probably its main substitute. We have, therefore, suggested an increase in the family's consumption of bread, from 20 lbs. per week to 21 lbs. 7 ozs., which seemed the more necessary since scarcity of fats—there was no suet available, or practically none—caused us to reduce the allowance of flour in our schedule from 3 lbs. 4 ozs. to 3 lbs. Kippers and herrings may be eaten with the bread for breakfast or supper, and their content of first-class protein would be useful for counterbalancing the loss of such protein in the reduced cheese ration, of 2 ounces per head per week in November as against 3 ounces in April. Since fresh herrings were cheap and plentiful in November we have assumed the purchase of 3 lbs. of them and omitted tinned salmon, which is a more

TABLE I. *Weekly 'Human Needs' Diet for a Family of 5 Persons*
Diet A

				Quantity	Price per Unit ¹ s. d.	Changes since April, 1946 Quantity	Outlay s. d.
(a) Rationed Foods <i>excl. Bread and Flour</i> :							
1	Meat	...	...	7 lb	10 ²	...	...
2	Bacon	...	...	15 oz.	1 9	...	...
3	Margarine	...	...	1 lb 14 oz.	9	...	...
4a	Cooking Fat	...	...	5 oz.	9	...	...
4b	Suet	...	...	...	...	— 4 oz.	— 4½
5	Sugar	...	...	3 lb 8 oz.	4	...	...
6a	Jam	...	...	4 oz.	1 1	...	+ 0½
6b	Syrup	...	...	1 lb	8 ³	+1 lb	+ 8
7	Tea	...	...	8 oz.	2 8	...	...
8	Cheese	...	...	10 oz.	1 1	— 5 oz.	— 4
9a	Eggs, shell	...	...	4 eggs	2	— 6 eggs	— 1 0
9b	Eggs, dried	...	...	½ packet ⁴	1 6	+ ½ packet	+ 9
10	Dried Peas	...	...	1 lb	10	...	...
11	Oatmeal	...	...	1 lb	3½	— 1 lb 8 oz.	— 5½
12a	Macaroni...	...	...	8 oz.	9	...	+ 0½
12b	Semolina	...	...	1 lb 8 oz.	7	...	+ 4½
13	Dried Fruit	...	...	...	...	— 1 lb	— 9
14a	Household Milk	...	...	1 tin ⁵	9	+ 1 tin	+ 9
14b	Cond. Milk, skimmed	...	...	...	...	— 1 tin	— 5
15	Tinned Salmon	...	...	...	...	— 1½ tin	— 1 0
Outlay on Group (a)				...	17 9½	...	— 1 8½
(b) Fresh Milk :							
16a	Ordinary	...	...	15½ pt.	4½	...	...
16b	School	...	...	5 pt.	free	...	— 7½
Outlay on Group (b)				...	5 9½	...	— 7½
(c) Main Carbohydrate Foods :							
17	Bread	...	...	21 lb 7 oz.	4½ ⁶	+1 lb 7 oz.	+ 10½
18	Flour	...	...	3 lb	3	— 4 oz.	— 0½
19	Potatoes	...	...	21 lb	1	...	— 3
Outlay on Group (c)				...	7 7½	...	+ 6½
(d) Vegetables <i>excl. Potatoes</i> :							
20a	Swedes	...	...	3 lb 8 oz.	2	...	...
20b	Carrots	...	...	3 lb 8 oz.	1½	...	...
20c	Cabbage	...	...	7 lb	3	...	7
Outlay on Group (d)				...	2 10½	...	— 7
(e) Other Foods :							
21	Cocoa	...	...	4 oz.	1 8 ⁷	...	+ 0½
22	Condiments	...	...	...	4	...	...
23	Apples	...	...	1 lb	6	+1 lb	+ 6
24a	Herrings, fresh	...	...	3 lb	6	+3 lb	+ 1 6
24b	Kippers	...	...	1 lb 8 oz.	10	+1 lb 8 oz.	+ 1 3
25	Pork Sausage Meat	...	...	12 oz.	1 1	...	...
Outlay on Group (e)				...	4 9½	...	+ 3 3½
Total Outlay on Diet A				...	38 4½	...	+ 10½

¹ Eggs in shell, price per egg ; dried eggs, price per packet ; Household milk, price per tin ; fresh milk, price per pint ; bread, price per loaf of 28 ounces ; condiments, total outlay ; all other foods, price per lb. ² Average price. ³ Bought in 2 lb. tin. ⁴ Equivalent to 6 eggs in shell. ⁵ Equivalent to 4 pints of skimmed fresh milk. ⁶ Since April 1946, the size of the 4½d. loaf has been reduced from 2 lbs. to 28 ounces. ⁷ Bought in ½ lb. tins.

expensive food. Syrup, which is enjoyed by many people with bread and puddings, is a useful source of calories; about 11 ounces of it were required for replacing the sugar content of the condensed milk and the dried fruit that formed part of our schedule for April. Apples were in season in November, and although not an essential constituent of a 'human needs' diet they are valuable in enhancing its variety and making it more appetizing, which was the more important since no dried fruit is included in our schedule for November.

Rises in price and changes in purchases had affected the cost of the diet since April, and it would have advanced by 1s. 6½d. but for the introduction of free milk at school, which reduces this amount by 7½d., to 10¾d., i.e., to 2.4 per cent. of the total cost in April instead of 4.1 per cent.

3. *Variations in the Basic Diet. Expenditure on 'Points' and 'Bread Units'.*

Certain variations in the 'human needs' diet, at somewhat higher costs, are suggested in Table II. Diet B assumes that meat of a higher average price was purchased, costing 1s. per lb instead of 10d. The family's weekly ration of 5s. 10d. worth of meat is thereby reduced by 1 lb. 3 ozs., which could be about replaced by 8 ounces of tinned salmon, 8 ounces of sausage meat, and, on account of their content of iron, 6 ounces of prunes.

In diet C we have supposed that the housewife had to find substitutes for oatmeal for the family's breakfasts, and in diet D she had to replace not only the oatmeal but also the dried eggs. It will be noticed that diet D cost actually less than diet C; yet it is preferable for the housewife to have the egg powder, included in diet C, since without it she might find it difficult to utilize the 3 lbs. of flour required for a sufficiency of calories. Finally, in diet E, we have considered the purchase of the family's sweets ration, in the nutritionally most economical form of chocolate. The additional nutritional intake could be offset by a small reduction in the consumption of cheap carbohydrate foods, at a net increase in the cost of the diet of 1s. 8¾d.

In Table II are also listed the amounts of 'points' and 'B.U.s' required for each diet. In Table III we have set out in detail the 'points' and 'B.U.s' needed for the purchase of diet A. The number of 'points' available in November per person per week was 8; the number of 'B.U.s' for an average adult—male or female—and for a child between 5 and 7 years old, was 9; for a child between 7 and 11 years it was also 9, while for one between 11 and 12 years old it was 13. We have assumed the family to include one child in this latter age group, so that for their two older children the average number of 'B.U.s' would amount to 11 per child per week. If the husband qualifies as a 'manual worker' there would have been for him another 6 'B.U.s'. This allowance, however, had to be disregarded by us, since it is granted on the assumption that it is required not by the individual as such but by a particular type of work necessitating the supply of additional calories.

Only 24 'points' are expended on diet A, but 58 instead of the family's basic 49 'B.U.s'. Another 9 'B.U.s' could, however, be obtained by

TABLE II
Weekly Low Cost Diets for a Family of 5 Persons
Diets B, C, D, and E

	Quantity	Outlay s. d.	' Points '	' B.U.s '
(1) Diet A	...	38 4½	24	58
(2) Excluding (Diet B) :				
Meat	1 lb 3 oz.	... ¹	...	...
Including (Diet B) :				
Salmon	½ tin ²	7½	4	...
Prunes	6 oz.	3½	3	...
Pork Sausage Meat	8 oz.	6½	...	...
Total Outlay on Diet B	...	39 10½	31	58
(3) Excluding (Diet C) :				
Oatmeal	1 lb	3½	2	...
Including (Diet C) :				
Bread	14 oz.	2½ ³	...	2
Dried Eggs	½ packet ⁴	4½	2	...
Salmon	½ tin ⁴	7½	4	...
Total Outlay on Diet C	...	39 3½	28	60
(4) Excluding (Diet D) :				
Oatmeal	1 lb	3½	2	...
Dried Eggs	½ packet ⁴	9	4	...
Including (Diet D) :				
Bread	14 oz.	2½ ³	...	2
Salmon	½ tin ²	7½	4	...
Macaroni	8 oz.	4½	1	...
Household Milk	½ tin ⁵	2½	½	...
Total Outlay on Diet D	...	38 8½	23½	60
(5) Excluding (Diet E) :				
Bread	1 lb 12 oz.	4½	...	2
Syrup	6 oz.	3 ⁶	3	...
Semolina	4 oz.	1½	½	...
Including (Diet E) :				
Plain Chocolate	1 lb 4 oz.	2 6	...	...
Total Outlay on Diet E	...	40 1½	20½	56

¹ No change in outlay ; average cost of meat raised from 10d. to 1s. a lb.

² 8 oz. ³ Bought as part of a 1½ lb. loaf.

⁴ One packet equivalent to 12 eggs. ⁵ Equivalent to 1 pint of skimmed fresh milk.

⁶ Bought in 2 lb. tin.

surrendering 9 'points'.¹ This would have left the family with 7 surplus 'points'. The full number of 'points' and 'B.U.s' are employed only for diet B, but diet C required nearly all of them, *viz.*, 88 'points' and 'B.U.s' out of a total of 89.

¹ 8 'points' are worth 8 'B.U.s' ; but, since October 13th, 1946, 8 'B.U.s' were worth only 4 'points,' and since December 1st, 'B.U.s' can no longer be exchanged for 'points.' With the present shortage of wheat it would, of course, be desirable to devise a diet relying on a lower bread consumption than in previous periods and not a higher one ; but the scarcity of oatmeal, barley flakes, and pulses (except green peas) leads, of necessity, to an increased consumption of other rationed calorific foods, the more important of which are derived from wheat ; bread is only the most widely acceptable type of them.

TABLE III
Foods Rationed on 'Points' and 'B.U.s' in Diet A

				Quantity	Points	B.U.s
Syrup	...	...	...	1 lb	10	...
Dried Eggs	...	...	...	$\frac{1}{2}$ packet	4	...
Dried Peas ¹	...	...	...	1 lb	2	...
Oatmeal	...	...	...	1 lb	2	...
Macaroni	...	...	...	8 oz.	1	...
Semolina	...	...	...	1 lb	3	...
Household Milk	...	...	...	1 tin	2	...
Bread	...	...	...	21 lb	7 oz.	49
Flour	...	...	...	3 lb	...	9
Total spent	...	...	...		24	58
'Points' and 'B.U.s' available	...	...	...		40	49
Difference	...	...	...		+ 16	- 9
'Points' changed into 'B.U.s'	...	...	...		- 9	+ 9
Unused	...	...	...		7	...

¹ Green.

4. *Individual Shares Available and their Nutritional Values.*

In our survey for April we attempted for the first time to show how—allowing for prevailing feeding habits—the 'human needs' diet might be distributed amongst the members of the family so as to supply each with the optimum share available to him while partaking in the family meals. We have done this again with respect to our diet schedule for November, in Table IV. The children are supposed to drink their full allowance of milk or consume it with liberal helpings of milk puddings, and the housewife to obtain one-fifth of her husband's ration of milk in addition to her own. A considerable amount of discrimination is suggested in the distribution of the other foods; in particular, we have accepted the general habit of giving the largest share of the savoury foods to the male earner. The individual shares of the foods as set out in Table IV are, of course, only approximations, and intricate fractions of quantities have been avoided. A number of the foods are obviously interchangeable without upsetting the nutritional balance.

By mid-November the family would probably have only been able to purchase a maximum of $2\frac{1}{2}$ eggs in shell per week instead of the 4 eggs included in our schedule, and the difference would have to be made up in dried eggs. Yet even then 2 eggs in shell might have gone to the husband, as a convenient and appreciated breakfast dish, and the dried eggs been reserved for the other members of the family. Little objection can be raised against this from a nutritional point of view. Bacon, again, serves as a breakfast food for the husband and, together with cheese, may also be required for sandwiches, if he occasionally takes a packed meal. Bread and cheese may further be preferred by him instead of pudding, for rounding off a meal.

For each member of the family the calorific intake from his share, is approximately 99 per cent of his average requirement, except for the youngest

TABLE IV
Diet A for 5 Persons: Individual Shares Available

		Husband	Wife	Child 7-12 ¹	Child 5-7
(a) Rationed Foods <i>excl. Bread and Potatoes</i> :					
1 ^a Meat	1 lb	12 oz.	1 lb	4 oz.	1 lb
2 Bacon		6 oz.	3 oz.	2 oz.	2 oz.
3 Margarine		7 oz.	7 oz.	6 oz.	4 oz.
4a Cooking Fat		1 oz.	1 oz.	1 oz.	1 oz.
5 Sugar		6 oz.	15 oz.	13 oz.	9 oz.
6a Jam		$\frac{1}{2}$ oz.	$\frac{1}{2}$ oz.	1 oz.	1 oz.
6b Syrup		2 oz.	4 oz.	3 $\frac{1}{2}$ oz.	3 oz.
8 Cheese		5 oz.	2 oz.	1 oz.	1 oz.
9a Eggs, shell	2 eggs		$\frac{1}{2}$ egg	$\frac{1}{2}$ egg	$\frac{1}{2}$ egg
9b Eggs, dried	1 egg ³		1 egg ³	1 $\frac{1}{2}$ eggs ³	1 egg ³
10 Dried Peas		6 oz.	3 $\frac{1}{2}$ oz.	2 $\frac{1}{2}$ oz.	1 $\frac{1}{2}$ oz.
11 Oatmeal		4 oz.	3 $\frac{1}{2}$ oz.	3 oz.	2 $\frac{1}{2}$ oz.
12a Macaroni		1 oz.	1 $\frac{1}{2}$ oz.	2 oz.	1 $\frac{1}{2}$ oz.
12b Semolina		2 oz.	7 oz.	5 $\frac{1}{2}$ oz.	4 oz.
14a Household Milk	$\frac{1}{2}$ pt. ^a		$\frac{3}{4}$ pt. ^a	1 pt. ^a	$\frac{3}{4}$ pt. ^a
(b) Fresh Milk :					
16a Ordinary		2 pt.	3 pt.	3 $\frac{1}{2}$ pt.	3 $\frac{1}{2}$ pt.
16b School	—	—	—	1 $\frac{1}{2}$ pt.	1 $\frac{1}{2}$ pt.
(c) Main Carbohydrate Foods :					
17 Bread ⁴	6 lb	12 oz.	5 lb	8 oz.	3 lb
18 Flour	1 lb	8 oz.		8 oz.	6 oz.
19 Potatoes	7 lb		3 lb	15 oz.	3 lb
(d) Vegetables, <i>excl. Potatoes</i> :					
20a Swedes	1 lb			12 oz.	10 oz.
20b Carrots		8 oz.		12 oz.	12 oz.
20c Cabbage	1 lb	10 oz.	1 lb	6 oz.	1 lb
(e) Other Foods :					
21 Cocoa	—		1 oz.	1 oz.	1 oz.
23 Apples		3 oz.	3 oz.	3 $\frac{1}{2}$ oz.	3 oz.
24a Herrings, fresh		12 oz.	12 oz.	8 $\frac{1}{2}$ oz.	7 oz.
24b Kippers		8 oz.	7 oz.	3 oz.	3 oz.
25 Pork Sausage Meat		4 oz.	2 oz.	2 oz.	2 oz.

¹ Two children in this age group.

² The serial numbers correspond to those in Table I.

³ Equivalent. ⁴ 14 oz. of bread unallotted.

child whose requirement is covered fully by his intake. However, 14 ounces of the total amount of bread in Table I have remained unallotted individually, in order to provide a small margin for adjustments according to individual wants, which may vary from week to week. If this bread were distributed amongst the individual diets the calorific intake could be raised for all the members to 100 per cent of their requirements.

The nutritional intake from the shares as set out in Table IV is shown in Table V. The upper section of Table V lists the individual requirements as laid down by the Ministry of Health, and it also gives the 'man' values of the family according to them, for the seven main nutrients. In the lower section will be found the net nutritional intake per individual per day and the average intake per 'man', the latter for both April and November. The data have been calculated by means of the *Tables of Nutritive Values* issued by the Medical Research Council.¹ In compiling the intake of vitamin A we have followed the advice offered in that publication, by dividing the values of

¹ War Memorandum No. 14, H.M.S.O., 1945.

TABLE V
Nutritional Requirements and Intake from Diet A

Nutritional Requirements (Ministry of Health Scale) :	Per Person per Day				' Man ' Values of Family of 5 Persons ¹
	Husband	Wife	Child 7-12	Child 5-7	
Calories ...	3,000	2,500	2,100	1,500	3.73
Protein, gm. ...	70	60	65	50	4.43
Calcium, gm. ...	0.8	0.8	1.4	1.3	7.13
Iron, mgm. ...	10	10	13	8	5.40
Vitamin A, I.U. ...	3,000	3,000	3,000	3,000	5.00
Vitamin B ₁ , mgm. ...	0.90	0.75	0.95	0.68	4.68
Vitamin C, mgm. ...	30	30	30	30	5.00
<i>Individual Intake from Diet A (Table IV) :</i>					
	Husband	Wife	Child 7-12	Child 5-7	Av. Intake p. ' Man ' ¹
Calories ...	2,965	2,480	2,070	1,510	Nov. 1946 3,000 Apr. 1946 3,070
Protein, gm. ...	105.9	81.6	70.2	52.9	87.1 83.3
Calcium, gm. ...	1.0	0.9	0.9	0.8	0.64 0.62
Iron, mgm. ...	16	12	11	8	11 11
Vitamin A, I.U. ...	3,300	3,900	3,990	3,730	3,790 3,830
Vitamin B ₁ , mgm. ...	1.9	1.4	1.2	0.9	1.4 1.4
Vitamin C, mgm. ...	57	40	42	30	42 41
<i>Animal Protein:</i>					
gm. ...	39.7	32.5	36.6	31.0	39.8 34.9
of protein requirements	56.7%	54.2%	56.3%	62.0%	56.9% 50.0%

¹ Including 14 oz. of bread not allotted to individual members.

the pro-vitamin (carotene) by 3 before adding them to the values of vitamin A. Of the content of vitamin C of potatoes, swedes, and carrots, 50 per cent have been deducted by us for losses in cooking, and 75 per cent with respect to cabbage. For apples we reduced the actual figure of vitamin C by 30 per cent. It will be seen that with the exception of the children's intake of calcium, the main nutritional requirements are, on the whole, well covered. As against the diet for April 1946, the total diet for November reveals a slight decline in calorific intake while being superior to it as regards the supply of protein, in particular of animal protein. In this is reflected the replacement of some of the second class protein of oatmeal by the first-class protein of fish.

In Table VI we survey briefly the nutritional gross intake per ' man ' ,

TABLE VI
Institute of Statistics Scale of Nutritional Requirements and Intake from Diet A

	Per ' Man ' per Day ¹				Protein	
	Calories				animal	vegetable
Gross Requirements ...	...	...	...	3,300	50	50
Gross Intake : April 1946 ...	...	...	...	3,300	50	51
November 1946 ...	...	...	...	3,250	56	51

¹ ' Man ' value of family of 5 persons : 3.75.

in November and April respectively, as calculated by means of our original Tables of ' man ' values and nutritional values, which we employed in this series for all our calculations until preciser data were made available to us by the courtesy of the Ministry of Health, in summer, 1943. The figures in Table VI are given for the sake of comparison with those in our earlier articles; but it should be borne in mind that the ' man ' values on which they

are based differ from those used for the calculation of all the other tables in this paper; they amount, for the family, to 3.75, for both calorific and protein requirements.¹

5. *Rationing and Food Intake.*

The individual intake of nutrients from the several food groups, according to the data of food consumption in Table IV, is analysed in Table VII. Two main points spring to the eye; first, the very large proportion of all the nutrients except vitamins A and C, derived from rationed foods; secondly, the important role played in the nutrition of the children, by fresh milk—group (b) —, and in the nutrition of the adults, by the cheap carbohydrate foods—the rationed foods in group (c).

The data of calcium intake are dealt with in more detail in Table VIII. For the husband, the intake of calcium from all milk and cheese on the one hand, and from bread, flour, oatmeal, dried peas, and potatoes, on the other, stand in about equal proportion; for the wife, the ratio is 5.0 : 3.2; for the older children it is 6.7 : 1.8, and for the youngest child 7.1 : 1.3. It thus appears that the satisfactory figures of calcium intake of the two adult members, of the family, shown in Table V, depend largely on the adults' ability to consume substantial quantities of the cheap carbohydrate foods, which for them are also the main sources of calories. Yet Table IX reveals that the necessary quantities of these foods can be obtained by them only as members of a family with young children, through drawing their shares of food from a fairly large common pool of rations.

In Table III we have shown that of the 'points' available to the family per week, 7 remain unused for the purchase of diet A. Table IX, however, makes it clear that as far as the adults are concerned, there accrued not only no surplus but actually a deficiency of 'points'; in order to feed them adequately 9 more 'points', or 'B.U.s', would be required than are available to them in their rations. It is true that the figures of nutritional intake in Table V indicate for the two adults substantial surpluses of certain nutrients, which, however, are concomitant with the intake of the cheap calorific foods—mainly bread and flour. For calories exclusive of protein and other nutrients can be derived only from fats and sugar.

It thus becomes evident that those normal adults who are unable to have meals out and who are compelled to rely on their individual rations, must go short, although the average distribution of rations for a family with young children appears satisfactory. The deficiency of calorific foods in the rations of the two adults, amounting to 15 per cent of their total calorific intake shown in Table V, is far too substantial to be made good by unrationed foods, excepting main meals purchased in good canteens or restaurants. For apart from the fact that the allowances in our schedule of potatoes and vegetables for husband and wife are already fairly large, a pound of potatoe provides only 256 calories and a pound of the other fresh vegetables at most

¹ Husband, 1.00; wife, 0.85; child 10–14 years old, 0.70; 2 children 7–9 years old, 1.20.

TABLE VII *Relative Intake of Nutrients from 'Human Needs' Diet A*

			Group (a)	Group (b)	Group (c) <i>excl.</i> <i>Potatoes</i>	Potatoes	Group (d)	Group (e)	Total	
<i>Calories:</i>						<i>(Unrationed Foods)</i>				
<i>(Rationed Foods)</i>										
Husband	...	...	34.9	3.3	47.8	8.6	1.1	4.3	100.0	
Wife	...	...	42.2	5.9	40.0	5.8	1.3	4.8	100.0	
Child 7-12	...	...	46.6	12.2	28.5	7.0	1.5	4.2	100.0	
Child 5-7	...	...	46.7	16.6	24.3	5.3	1.7	5.4	100.0	
Total Diet ¹			...	42.0	8.9	36.4	6.8	1.4	4.5	100.0
<i>All Protein:</i>										
Husband	...	...	31.9	4.9	46.0	6.0	1.7	9.5	100.0	
Wife	...	...	30.6	9.5	41.8	4.4	2.0	11.7	100.0	
Child 7-12	...	...	35.7	19.0	28.8	5.1	2.3	9.1	100.0	
Child 5-7	...	...	33.9	25.1	23.7	3.8	2.5	11.0	100.0	
Total Diet ¹			...	32.9	13.6	36.5	5.0	2.1	9.9	100.0
<i>Animal Protein:</i>										
Husband	...	...	61.9	12.9	...	...	...	25.2	100.0	
Wife	...	...	49.5	23.8	...	...	...	26.7	100.0	
Child 7-12	...	...	48.7	36.3	...	...	...	15.0	100.0	
Child 5-7	...	...	41.3	42.8	...	...	...	15.9	100.0	
Total Diet			...	50.5	29.9	...	...	...	19.6	100.0
<i>Calcium:</i>										
Husband	...	...	27.3	19.9	35.0	3.3	8.6	5.9	100.0	
Wife	...	...	21.0	33.8	27.9	2.1	8.9	6.3	100.0	
Child 7-12	...	...	18.2	53.2	15.1	1.9	8.0	3.6	100.0	
Child 5-7	...	...	16.4	60.4	10.6	1.2	7.7	3.7	100.0	
Total Diet ¹			...	20.2	43.3	21.6	2.1	8.2	4.6	100.0
<i>Iron:</i>										
Husband	...	...	36.7	1.1	39.1	9.8	6.7	6.6	100.0	
Wife	...	...	36.0	2.1	34.7	7.2	7.8	12.2	100.0	
Child 7-12	...	...	42.9	4.1	24.2	8.4	9.1	11.3	100.0	
Child 5-7	...	...	41.9	5.7	20.8	6.5	10.3	14.8	100.0	
Total Diet ¹			...	39.1	3.0	31.0	8.2	8.2	10.5	100.0
<i>Vitamin A:</i>										
Husband	...	...	33.1	5.2	...	...	59.2	2.5	100.0	
Wife	...	...	20.5	6.6	...	...	70.9	2.0	100.0	
Child 7-12	...	...	17.6	11.1	...	...	70.1	1.2	100.0	
Child 5-7	...	...	13.3	11.9	...	...	73.7	1.1	100.0	
Total Diet			...	20.1	9.3	...	...	69.0	1.6	100.0
<i>Vitamin B₁:</i>										
Husband	...	...	21.8	3.9	46.1	21.7	4.6	1.9	100.0	
Wife	...	...	22.1	8.2	44.4	17.1	6.1	2.1	100.0	
Child 7-12	...	...	23.5	16.4	30.8	19.9	7.1	2.3	100.0	
Child 5-7	...	...	24.3	22.6	26.5	15.3	8.3	3.0	100.0	
Total Diet ¹			...	22.5	11.6	38.5	19.0	6.2	2.2	100.0
<i>Vitamin C:</i>										
Husband	...	...	0.6	3.0	...	56.5	39.1	0.8	100.0	
Wife	...	...	1.2	6.4	...	44.8	46.5	1.1	100.0	
Child 7-12	...	...	1.6	10.6	...	43.1	43.5	1.2	100.0	
Child 5-7	...	...	1.7	14.7	...	33.3	48.9	1.4	100.0	
Total Diet			...	1.3	8.3	...	45.6	43.7	1.1	100.0

¹ Including in Group (c) nutrients derived from 14 oz. of bread not allotted to individual

Relative Intake of Calcium

				Husband	Wife	Child 7-12	Child 5-7
				%	%	%	%
All Milk ¹	...	...	...	25.0	42.5	63.7	69.4
Cheese	...	...	...	16.9	7.6	3.5	4.0
Herrings and Kippers	...	...	...	5.3	5.7	3.1	3.1
Bread and Flour	...	...	...	35.0	27.9	15.1	10.6
Oatmeal	...	...	...	0.9	0.9	0.7	0.7
Dried Peas	...	...	...	1.5	1.0	0.6	0.4
Potatoes	...	...	...	3.3	2.1	1.9	1.2
All other Vegetables	...	...	...	8.6	8.9	8.0	7.7
All other Foods	...	...	...	3.5	3.4	3.4	2.9
Total	...	...	...	100.0	100.0	100.0	100.0

¹ Including dried Household milk.

TABLE IX
Indices of Consumption of Rational Foods in Table IV

				Ration per Person per Week	Husband	Wife	Child 7-12 ¹	Child 5-7
				1s. 2d.	(Ration=100)			
Meat	...	...	...	3 oz.	125	89	107	71
Bacon	...	...	...	6 oz.	200	100	67	67
Margarine	...	...	...	1 oz.	117	117	100	67
Cooking Fat	...	...	...	12 oz.	100	100	100	100
Sugar	...	...	...	2 oz.	54	129	117	83
Jam	...	...	...		...	...	...	...
Cheese	...	...	...	2½ pt.	250	100	50	50
Milk, Adult	...	...	...	3½ pt. ²	80	120	...	...
Milk, Child	...	...	...	8	...	...	100	100
Husband { Points	...	...	...		140	...	...	...
Wife { Points	...	...	...	9	...	115	...	...
Child { Points	...	...	...	8	...	...	72	...
7-12 { Points	...	...	...	11 ³	...	...	...	...
Child { Points	...	...	...	8	...	...	...	55
5-7 { Points	...	...	...	9	...	...	...	...

¹ Two children in this group.

² Excluding 1½ pt. of school milk per child.

³ Average: child 7-11, 9 B.U.s; child 11-12, 13 B.U.s.

TABLE X
Surplus Consumption of Rational Foods in Combined Shares of Husband and Wife in Table IV

		Quantity.	Calories	Protein gm.	Calcium mgm.	Iron mgm.	Vitamin A I.U.	Vitamin B ₁ m gm.
<i>Surpluses obtained:</i>								
Meat	...	3.2 oz.	192	10.9	6	2.2	38	64
Bacon	...	3.0 oz.	387	6.6	9	0.9	...	330
Margarine	...	2.0 oz.	436	...	2	0.2	1,136	...
Cheese	...	3.0 oz.	351	21.3	690	0.6	1,107	27
Bread	...	64.9 oz.	4,543	155.8	1,103	19.5	...	2,726
Total	...	...	5,909	194.6	1,810	23.4	2,281	3,147
<i>Deficiency:</i>								
Sugar	...	2.0 oz.	216	...	...	...	...	...
Net Surplus	...	...	5,693	194.6	1,810	23.4	2,281	3,147
Of Total Intake	...	...	14.9%	14.8%	14.1%	11.6%	4.5%	13.7%

80 calories, while the daily intake of the two persons together would fall short by 810 calories.¹ The corresponding losses incurred of the other nutrients would be as follows: protein, also about 15 per cent, calcium 14 per cent, iron 11½ per cent, vitamin A 4½ per cent, and vitamin B₁, nearly 14 per cent. The surpluses of rationed foods from which, were they withdrawn, these deficiencies would arise, are set out in Table X.²

In Table IX will be found the relative outlay on diet A, in April and

TABLE XI
Relative Outlay on 'Human Needs' Diet A

	Rationed Foods, Nov. '46			Unrationed Foods, Nov. 1946			Total Outlay
	Group (a)	Group (b)	Group (c) <i>excl. potatoes</i>	Potatoes	Group (d)	Group (e) <i>excl. condmts.</i>	
April, 1946 ...	49.9	17.1	12.2 ¹	5.3	9.2	5.4	100.0
November, 1946	46.4	15.1	13.9	4.6	7.4	11.7	100.0

¹ Unrationed.

November, subdivided into the outlay on the several groups of rationed and unrationed foods. For April 1946, the whole of group (c) belongs to the section of unrationed foods, since the rationing of bread and flour was not introduced until July. The expenditure on rationed foods including milk amounted in April to about two-thirds of the total cost of the diet and in November to just over three-quarters of it.

6. Conclusion.

Our inquiry into the possible composition and the cost of a 'human needs' diet for a family in November 1946, showed that everyday shopping was exceptionally difficult for a housewife in Oxford during this period. It was, therefore, impossible to compile a diet schedule that can claim general validity, and certain qualifications had to be introduced. The cheapest diet of reasonable variety that could be purchased by a housewife catering for a family

¹ A dietician working in an industrial canteen informed us that 800 calories per main meal would be 'rather a high estimate'. Allowing for the fact that a substantial proportion of calories derived from a cooked meal are provided by potatoes and that it is, therefore, necessary to make a corresponding reduction in the amount of potatoes bought as such, one can, perhaps, assume that one meal for each of the adults on five days a week would fill the gap. If, however, the husband receives the six additional 'B.U.s' per week allowed to manual workers, without requiring more than his 'normal' 3,000 calories per day, 810 additional calories per day could be obtained by husband and wife without purchasing meals away from home; for 470 calories could come from bread, and 340 calories could be derived from various unrationed foods. Yet it would still be necessary for them to give up 9.3 'points' per week for 'B.U.s.'

² It is, of course, impossible to discuss in detail within the framework of this article the means that might be employed for bringing about a juster distribution of the individual rations. If, however, bread rationing is to stay for an indefinite period, as the Minister of Food seems to think inevitable, two fundamental alterations in the present system of rationing of bread and 'points' foods should be considered, *viz.*, a more realistic adjustment of individual allowances to relative individual needs of the different age and sex groups, and the inclusion in the system of all meals obtained in restaurants, canteens, and schools. By thus curtailing the total supply of essential foods in cases where it is now manifestly excessive, it would be possible to increase the allowances of those classes whose shares at present are falling dangerously short of average requirements, without raising total food consumption.

with three children of school age, cost $10\frac{3}{4}$ d. more than in April, although the children's milk at school was free in November, which saved $7\frac{1}{2}$ d. a week. The actual cost of the diet had thus risen by 2.4 per cent. If the outlay on school milk is omitted at both dates the rise in cost would amount to 4 per cent since April 1946, and to over 8 per cent since November 1945. The Ministry of Labour index of the cost of food has remained practically constant during this period.

The most important point, however, which accidentally emerges from this survey, is that the present rations for adults are insufficient for their proper maintenance. It appears that they can feed themselves adequately only if either they have the money and the opportunity of purchasing on most days a cooked meal away from home, or else if they are members of a family with young children and thus benefit by the fact that these children obtain rations which are larger than is necessary for their adequate nutrition.

T. SCHULZ.

ERRATUM

Rationing and Nutrition, BULLETIN, Vol. 8, No. 12.

The last three lines of footnote 1 on page 386 should read as follows: ' . . . for 420 calories could come from bread, and 390 calories could be derived from various unrationed foods. Yet it would still be necessary for them to give up 6.7 ' points ' per week for B.U.s '.

TABULAR APPENDIX

EDITORIAL NOTE

The following set of tables presents figures illustrating the economic development in U.S.A. and some European countries. As far as possible 1938 was taken as the base year, but it should be remembered that 1938 was in some countries a year of severe recession. The figures are given as far as possible as monthly or quarterly averages.

When statistical data of foreign countries become more easily available, we hope to add other countries and to include new series in this survey.

Explanation of Symbols

() — figure is provisional or approximate.

N.A. — figure is not available — — figure is negligible.

B. ECONOMIC DEVELOPMENTS ABROAD.

TABLE I. U.S.A.

Index Numbers 1938=100 ¹	Monthly		Average		1945 Aug.	1946			
	1939	1943	1944	1945		June	July	Aug. ²	Sept. ³
Income Paymts. (Mthly.) :									
Total, \$1,000 Mill. ...	5.9	11.9	13.0	13.4	12.7	14.5	14.0	13.5	N.A.
Index, adjusted ...	107	216	237	242	240	243	254	256	N.A.
Consumer Expenditures :									
Mthly. aver. \$1,000 Mill. ...	5.1	7.6	8.2	8.7	8.5 ⁴	10 ⁵	N.A.	N.A.	N.A.
Index, adjusted ...	105	156	168	179	173 ⁵	203	N.A.	N.A.	N.A.
Dept. Store Sales, Value									
Index ...	107	170	188	209	202	278	276	293	272
Vol Index of Farm Mkts. ⁶	109	133	140	137	139	131	155	139	N.A.
Vol. Index of Ind. Prodn. ⁶	122	268	264	228	209	191	193	199	199
Durable Manuf. ...	140	461	452	351	306	246	259	265	296
Non-durable Manuf. ...	115	185	180	175	165	170	166	171	169
Constrcn. Contr. Awarded									
Value Index ...	113	106	64	106	95	272	258	242	N.A.
Vol. Index ⁶ ...	113	86	50	81	73	181	169	159	N.A.
Index of Non-Agr. Empl. ⁷	106	139	135	129	133	136	137	138	N.A.
Index of Factory Emplty. ⁸	111	197	191	166	164	155	156	159	161
Index of Wholesale Prices	98	131	132	134	135	144	158	164	158
Do. Farm Products ...	94	179	180	186	185	204	229	235	N.A.
Cost of Living Index	98	123	124	127	128	132	140	142	144
Facty. Av. Hrlly. Earngs. cts.	63.3	96.1	101.9	102.3	102.4	108.4	109.3	111.0	N.A.
Do. 1938=100 ...	101	153	162	163	163	173	174	177	N.A.
Mthly. Com. Expts. ⁹ Mill. \$	260.3	206.9	238.0	336.6	304	801 ¹⁰	770	825	613
Mthly. Ret. Impts. Mill. \$...	189.7	281.7	322.4	339.5	355	371	420	414	376

Sources : Department of Commerce for Income Payments, Consumer Expenditures and Farm Marketings ; Board of Governors of the Fed. Res. System for Industrial Production and Department Store Sales ; U.S. Dept. of Labor for Wholesale Prices, Cost of Living, Employment and Hourly Wage Earnings ; F. W. Dodge Corp. for Value of Construction Contracts awarded.

¹ All index numbers, except those of wholesale prices, cost of living (and wages) are adjusted for seasonal variations.

² Partly provisional.

³ Monthly average, 2nd quarter.

⁴ 1935-1939=100.

⁵ Mining and Manufacturing.

⁶ Value Index deflated with (Engineering News Record) Index of Construction Costs.

⁷ All non-agricultural wage—and salary earners except those in Domestic Service and in the Armed Forces.

⁸ Revised series.

⁹ Excluding Lend Lease and Re-exports but including U.N.R.R.A. supplies.

¹⁰ The figures for exports April-June, 1946, in BULLETIN, No. 10 were given as figures for imports, and vice versa.

TABLE II FRANCE

Index Numbers 1938=100	Monthly average			1946				
	1939	1943 ¹	1945	June	July	Aug.	Sept.	Oct. ²
Production of Coal ³								
1,000 metr. tons	4,185	3,538	2,922	3,831	4,110	4,136	4,056	4,707
Index	106	89	74	97	104	104	102	119
Production of Steel								
1,000 metr. tons	617	194	134	345	377	390	419	477
Index	128	38	26	67	73	76	81	92
Index of Production of :								
Cement	N.A.	74	44	100 ⁴	106	99	110	131
Commercial Vehicles	N.A.	48	83	174	187	85	179	206
Passenger Cars	N.A.	—	0.85	15	18	10	23	30
Cotton Fabrics	N.A.	17	22	71	69	53	N.A.	N.A.
Index of Wholesale Prices ⁵	N.A.	218	366	582	531	654 ⁶	673	740
Index of Retail Prices ⁷	108	224	393	577	576	730 ⁸	785	858
Imports 1,000 Mill. frs.	3.6	1.2	4.6	28.5	23.3	20.3	18.4	23.5
Exports 1,000 Mill. frs.	2.6	2.9	0.9	8.5	7.9	8.6	9.6	11.0
Imports 1,000 tons	3,262 ⁹	388	859	3,093	2,690	2,621	2,586	2,730
Exports 1,000 tons	2,083 ⁹	1,067	220	888	859	826	958	901

Sources : Statistique Générale de la France ; La Vie Française, Hebdomadaire Économique et Financier ; League of Nations, Monthly BULLETIN of Statistics.

¹ The Production figures for 1944 exclude Alsace-Lorraine.

² Partly provisional.

³ Including lignite.

⁴ Corrected Series.

⁵ 1941 weights.

⁶ The series includes since August certain uncontrolled prices.

⁷ Retail prices in Paris of 34 articles.

⁸ 3,929,000 tons in 1938.

⁹ 2,249,000 tons in 1938.

TABLE III BELGIUM

Index Nos. 1936-38=100 Monthly figures or averages				1945		1946			
	1939	1943	1945	Aug.	Sept.	June	July	Aug.	Sept.
Industrial Prod. : Index									
General	95	N.A.	35	40	45	77	81	81	N.A.
Coal	102	N.A.	53	53	60	78	75	76	N.A.
Iron	91	N.A.	28	31	36	73	75	76	N.A.
Textiles	99	N.A.	35	48	54	94	102	105	N.A.
Food Ind.	98	N.A.	36	42	45	60	74	66	N.A.
Coal Prod. 1,000 m. tons	2,487	1,979	1,310	1,267	1,409	1,822	1,828	1,838	1,887
Steel Prod. 1,000 m. tons	259	139	61	70	81	182	201	198	198
Imports ¹ Mill. frs.	2,018 ²	535	1,144	1,524	1,697	4,132	4,017	5,203	4,624
Exports ¹ Mill. frs.	1,850 ²	743	331	364	501	2,242	2,890	2,274	2,997
Imports ¹ '000 tons	2,868 ²	659	632	922	963	1,468	1,597	N.A.	N.A.
Exports ¹ '000 tons	1,912 ²	537	121	139	204	575	719	N.A.	N.A.

Sources : BULLETIN DE STATISTIQUE (Office, Central de Statistique) : Monthly BULLETIN OF STATISTICS, League of Nations.

¹ Figures for 1936-38 and after April 1945 refer to Belgium-Luxemburg.

² Monthly average 1936-1938.

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TABLE IV SWITZERLAND

Index Nos. 1938=100	1939	1943	1944	1945	1945 Oct.	1946			
						July	Aug.	Sept.	Oct.
Index of:									
Industrial Employment ¹	99	105	100	110	112 ²	N.A.	124 ³	N.A.	N.A.
Wholesale Prices	104	204	208	206	205	199	200	198	202
Cost of Living	101	148	151	152	152	151	151	151	154
Tourism (monthly) ³	77	24	26	42	59 ⁴	100	154	N.A.	N.A.
Monthly Impts. Mill. frs.	157	144	99	102	168	268	265	255	304
Monthly Expts. Mill. frs.	108	136	94	123	148	269	217	237	269
Index of Imports at 1938 prices	117	47	32	31	48	106	100	94	114
Index of Exports at 1938 prices	96	63	40	57	74	121	96	110	120

Sources: Schweizerische Nationalbank, Monatsbericht.

¹ Number of wage-earners employed in a representative sample of establishments, including building. Quarterly figures or averages.

² 3rd quarter.

³ Based on the statistics of nights spent by foreign tourists in Swiss hotels.

⁴ August.

TABLE V DENMARK.

Index Numbers 1938=100	1939	1943	1944	1945	1945		1946			
					Sept.	Oct.	July	Aug.	Sept.	Oct.
Index of:										
Industrial Production ¹	105	87	87	79	78	83	97	99	101	103
Productn. of Animal Prods.	103	58	68	68	72	69	82	73	74	75
Productn. of butter	96	66	67	69	84	75	94	88	81	74
Productn. of bacon	99	51	65	59	52	52	67	48	54	63
Wholesale Prices	105	191	194	190	187	184	184 ²	191	192	197
Cost of Living	101	155	157	159	N.A.	159	157	N.A.	N.A.	159
Monthly Imports Mill. Kr.	145	102	97	59	70	75	259	315	297	331
Monthly Exports Mill. Kr.	131	103	112	75	86	99	136	147	155	184
Index of Imports at 1938 prices	98	34	32	21	25	28	97	112	106	112
Index of Exports at 1938 prices	101	44	46	32	38	43	59	60	63	74

Source: Statistike Departement, Statistike Eftnerretninger.

¹ Adjusted for seasonal variations.

² Corrected figure.

TABLE VI SWEDEN

Index Numbers 1938=100	1939	1943	1944	1945	1945 Sept.	1946			
						June	July	Aug.	Sept.
Index of:									
Industrial Production ¹	106	93	93	91	104	109	107	107	108
Industrial Employment ²	103	102	103	99	110	111	110	110	110
Wholesale Prices	103	175	175	173	170	165	165	164	164
Cost of Living	102	144	145	146	146	146	N.A.	N.A.	146
Monthly Imports Mill. Kr.	208	151	139	91	135	283	300	290	296
Monthly Exports Mill. Kr.	157	98	69	146	245	222	238	193	233
Index of Impts. 1938 prices	109	33	35	21	32	73	78	75	N.A.
Index of Expts. 1938 prices	106	37	26	56	94	81	87	70	N.A.

Source: Skandinaviska Banken, Quarterly Review; League of Nations, Monthly Bulletin of Statistics.

¹ Mining and manufacturing. ² Number of wage-earners in mining and manufacturing.

TABLE VII
COAL MINING IN PARTS OF EUROPE¹

A. Employment and Output, September—October, 1946.

	Employment ('000) ²		Productn. ('000 m. tons) ³			October 1946		
			Monthly			Empl'y't	Prodn.	Output p. man- shift ⁴
	Sept.	Oct.	Jan-June Aver.	Sept.	Oct.			
Poland ...	185	N.A.	3,612	4,155	4,149	N.A.	82 ⁵	N.A.
Czechoslovakia ...	N.A.	N.A.	1,165	1,175	N.A.	N.A.	105 ⁶	N.A.
W. Germany ⁷ ...	231	234	4,808	5,182	5,736	74	51	55 ⁸
France ⁹ ...	321	326	3,834	3,897	4,707	145	121	73
Belgium ...	158	159	1,879	1,875	2,080	115	88	74
Holland ...	36	35	635	750	804	115	74	55

B. Total Imports of Solid Fuels including Bunkers.

Monthly Figures.

	Average Jan. to June 1946	1,000 metric tons		October 1946	Oct. Imprts. as % of mthly. aver. 1935-38
		August 1946	September 1946		
France ...	838	1,156	991	734	37
Belgium ...	308	270	217	237	45
Holland ...	244	370	314	214	30
Luxemburg ...	140	202	168	156	61
Norway ...	151	206	121	155	61
Denmark ...	325	408	364	333	70
Sweden ...	245	382	344	380	58
Switzerland ...	117	143	163	134	49
Italy ...	N.A.	882	578	314	29

C. Exports of Solid Fuels excluding Bunkers.

Monthly Figures

	Average Jan. to June 1946	1,000 metric tons		September 1946	Sept. Expts. as % mthly. av. 1935-38
		July 1946	August 1946		
Poland ...	1,155	1,531	1,487	1,382	N.A.
Czechoslovakia ...	N.A.	N.A.	N.A.	19	6
West Germany ⁷ ...	1,150	1,113	1,436	1,053	37
France ...	44	10	16	14	14
Belgium ...	78	85	77	80	16
Holland ...	36	30	34	33	7

Source: European Coal Organisation.

¹ Figures to nearest '000 workers and metric tons. October figures provisional.

² Underground and Surface Workers excluding Office Staff.

³ Hard coal (clean coal raised to the surface).

⁴ Underground and surface workers. The figures refer to September, 1946.

⁵ October, 1946, output compared with pre-war output in the territories now within Polish boundaries.

⁶ September, 1946.

⁷ British and French zones.

⁸ British zone only. Output per manshift in the French zone was 82% of pre-war.

⁹ Including lignite.

